



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

ON THE USE OF THE SUCKING-FISH FOR CATCHING FISH AND TURTLES: STUDIES IN ECHENEIS OR REMORA, III

DR. E. W. GUDGER

AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY

ARE THESE ACCOUNTS CREDIBLE?

Even with the cumulative evidence of all the foregoing accounts, the matter seems almost incredible. Dr. Eastman, when working up the data for his *Reversus* paper, wrote Dr. David Starr Jordan, and I also have written him. Dr. Jordan, without having had laid before him the later accounts found in this paper, doubts the Columbus stories and kindly gives some data from his own wide experience. He notes that the *Remora* rarely grows over sixteen inches long, and, although it holds so tightly that it may be drawn out of water, is so small that it could hardly be used as a hunting fish. He further adds that *Echeneis* though it grows to a length of three feet doesn't "sit tight" but drops off the minute "the shark to which it is fastened is drawn out of the water." This observation of Dr. Jordan's is in full accord, it may be noted, with the records left by Columbus and his chroniclers that the fish cannot stand access to the air, and hence they affirm that, while it cannot by pulling be dislodged from its prey, it may easily be disengaged by lifting both hunter and hunted up into the air when the former at once drops off.

In this connection it is pertinent to give here an observation which I made at Beaufort, N. C., a number of years ago. A shark was hooked off the laboratory wharf and when pulled in was found to have an *Echeneis* attendant about a foot long. As shark and *Echeneis* were both drawn up, whenever the latter was elevated above the water it would let go, drop down into the water, and take

a fresh hold. This was repeated several times, but at last the sucking-fish dropped off and swam away into deeper water.

A shark, which I hooked at Tortugas, had two *Echeneis* and one *Remora* on it. Being rapidly dragged up on the beach, the attendants did not let go until the shark was high and dry. One *Echeneis* was captured but the other two "suckers" got back in the water, and in many other cases I have been unable to bring the fish out with the shark. Dr. Townsend, however, writes (1915) that he has taken many sharks while on the United States Fisheries Steamer *Albatross*, and that nearly all of them came aboard with one or more *Echeneis* attached. Thus it would seem that in some cases the *Echeneis* holds fast and that in others it lets go. The causes of these different actions are not clear.

However, it is after all not a question of whether the sucking-fish lets go when brought into the air, but whether it can stand the strain of hauling in a heavy turtle or large fish. Hence the question is one to be settled by experiment and if possible by mathematics.

Holder (1905) has been quoted as having tried the experiment but without results since his "suckers" would not leave the sides of his boat to lay hold of the turtles and sharks. No record has been found of any similar experiments. In the same paper Holder speaks of lifting a bucket of water by a *Remora* which gripped the bottom with its disk.

Dr. C. H. Townsend, in an article in the *Bulletin* of the New York Zoological Society (1915), describes experiments to test the holding powers of sucking-fish in the New York Aquarium. A two-foot specimen (size of disk not noted) held by the tail lifted a pail half full of water—total weight 21 pounds. A second, 26.5 inches long and having a disk 5.5 inches in length, supported a pail and water weighing 24.25 pounds. Had a deeper bucket been used so that the water would not spill out, Dr. Townsend thinks that the fish could have lifted an even greater

weight. Fig. 11, Plate III, is reproduced from the article in question.

Dr. Townsend made another and even more pertinent experiment which we will let him describe in his own words:

By way of testing its fish-catching capacity, a shark-sucker sixteen inches long was liberated in one of the tanks of the Aquarium containing fishes. It took hold at once, and by hauling on the cord fastened to its tail a good-sized grouper was brought to the surface of the water, although it could not be lifted out of the tank. When the fish began to struggle the shark-sucker let go. When tried on a fifteen pound sea turtle, the latter could easily be drawn to the surface.

There can be no doubt that with a line attached to a large remora [*Echeneis*?] a much larger sea turtle could be hauled in without difficulty.

My opportunities for making such experiments have unfortunately been very few. At Tortugas in 1914, I pulled on the tail of a sucking-fish, stuck fast to the glass wall of the aquarium, so hard that its muscles could be heard to crack, and I had to desist for fear of pulling the tail off. In 1913 in the Bight of Cape Lookout, N. C., we caught a 27.25 inch *Echeneis* having a sucking disk 6 inches long by 2.13 wide. When stuck to the wet deck, I pulled on this fish so hard that I feared that I would tear it in two, but it resisted all efforts to pull it off backwards—a pull of possibly 50 pounds. On pulling upwards on it, it held fast until the disk began to tear loose from the head.

Another fish 33 inches long, with a sucker 7.25 x 2.63 inches, caught on the same day, was also experimented on but it was not in good condition and did not have the “grip” of its predecessor. A spring balance was attached to its tail, and the fish was found to resist a pull of 14 pounds lengthwise and 17 at an upward angle of 45 degrees. The other fish would undoubtedly have shown better results. In both the popping of the muscles was noted. The literature is found to be filled with statements that the fish holds tight so strongly that it will suffer itself to be torn in two rather than let go.

In ascertaining the “pull” that an *Echeneis* might

withstand when used as a fisherman-fish, the problem may be attacked from two standpoints. One might first ascertain how much adhesion the sucker would develop or secondly work out the "pull" necessary to land a turtle or large fish. This has never before been attempted, but it is worth while trying.

My largest *Echeneis* had a sucking disk whose longest diameter measured 7.25×2.63 inches. Assuming that it was an ellipse in shape let us proceed to get its area. The formula for the area of an ellipse whose longest diameters are a and b is as follows: $\text{Area} = \pi \times a \times b/4$. Substituting and performing the operations indicated we get 14.98 square inches for the area. This is of course too large, for no allowance has been made for the longitudinal raphe or for the lamellæ arranged like the slats of a Venetian blind. This cannot be ascertained but we will allow 1.48 square inches for this and thus reduce the available sucking area to 13.5 square inches. It is understood that the fish adheres to its host by raising its disk through muscular action and thus creating a partial vacuum. If this vacuum were perfect the adhesion would be 13.5×14.7 pounds or 198.45 pounds, or in round numbers 198 pounds would be the measure of the adhesion of the disk to the host fish, shark or turtle.

But it is objected that the disk can not develop a perfect vacuum, and as this is true our figures must be reduced. Let the reduction be 50 per cent. and the adhesion is still 99 pounds, or if it be cut by three fourths the adhesion will still be 49.5 pounds. The latter is probably too low just as the first is undoubtedly too high. For one thing there has not been and can not be figured out the additional adhesion developed by the backwardly directed teeth of the lamellæ, which were formerly thought to do all the holding. Assuming that the holding force is 99 pounds, it will be seen that when I pulled on this fish's tail with a pull estimated at 50 pounds the limits of its adhesion had not nearly been reached. And yet at the time it was noted that the muscles of the fish snapped and

cracked until it looked as if its tail would be pulled off. Furthermore, scores of observers have noted that the fish would allow itself to be pulled in two rather than let go. In Dr. Townsend's article, Mr. L. L. Mowbray, of the New York Aquarium, is quoted as believing that the fish under strain while under the weight of a considerable column of water *can not* relax the grip of its disk. With a backward pull on its tail the teeth setting in the epidermis of its host would tend to keep the lamellæ vertical, for the lamellæ can only come to rest, relaxing the grasp of the disk, by describing an arc backward and downward. Whether or not Mr. Mowbray's suggestion is tenable, it is certain that with a strong pull backward on its tail the *Echeneis* would find it hard, perhaps impossible, to flatten the disk and let go its hold.

The data offered above ought to convince any one that *Echeneis* can hold on tightly enough to enable the fisherman to haul in the prey thus laid hold of by the fish, but whether the fish, without being literally torn in two can stand the strain of this hauling in is a question that must be met. The answer here is an unhesitating "Yes"!

Dr. Townsend pulled on his 26.5-inch sucking-fish having a 5.5-inch disk with a measured force of 24.25 pounds. Let us see what a pull so great as this will do in landing a large fish. Dr. Charles Frederick Holder has done more than any man in America to popularize the taking of big game fishes with light tackle. In his "Big Game Fishes of the United States" (1903) to face page 80 he has a photograph of a 251-pound tuna (*Thynnus thynnus*) caught on a 21-thread line tested to break at 42 pounds dead pull. On page 115 he tells of the capture of a 419-pound black sea bass (*Stereolepis gigas*), and to face page 116 gives a photograph of it. The size of the line is not given but it is elsewhere specifically stated that it was not over 24-thread having a breaking strength of 48 pounds. In his "Big Game at Sea" (1908) on page 129 Holder gives a table of nine tunas ranging from 94 to 251 pounds in weight and none caught on lines of more than 24

threads and many on 15- and 18-thread lines. On the following page (130) he tabulates the weights of eight black sea bass ranging from 327 to 436 pounds caught on number 24 lines. Again on page 109 he states that Edwin vom Hofe took a 600-pound sawfish on a 15-thread line breaking at 30 pounds dead pull. On pages 166-167 of his "Recreations of a Sportsman on the Pacific Coast" (1910) Holder describes the catching of an 8- or 9-foot shark with a 9-thread line, and on page 169 he describes the taking of a 12-foot, 310-pound shark with a tuna rod and reel, the line of which was not heavier than 24 threads. Examples might be still further multiplied, but enough have been given to establish the facts.

Now the tuna is probably the hardest fighting game fish in the world taken on a light line, while the black sea bass and the sharks are undoubtedly the heaviest dead weights of any fishes taken with rod and reel. Thus the argument is that if these fishes can be taken on lines breaking at dead weight pulls of from 18 to 48 pounds, then an Eche-neis, which, suspended by a cord around its tail, supports a dead weight of 24.25 pounds, could easily be used to draw in fish and turtles of the sizes noted throughout this paper. And this without any danger of tearing its tail off.

To the present writer, all the evidence at hand sustains and confirms the stories of the living fishhook from the time of Columbus to the present day.

POSTSCRIPT

Since this paper was written I have chanced upon an article by F. Tamborini, bearing the title "Jagd- und Kunstschafterdienst im Meere," published in "Die Natur," 1900, Vol. 49, pp. 234-235. Examination of this shows that it contains nothing new, but note is made of it here that this may be understood and for the sake of completeness.

BIBLIOGRAPHY

Aldrovandi, Ulyssis.

1613. De Piscibus et de Cetis, p. 368, fig. Bononiæ.

Bachiller y Morales, Antonio.

1883. *Cuba Primitiva: Origen, Lenguas, Tradiciones de Historia de los Indios de las Antillas Mayores y las Lucayas*, p. 277. Habana, 2 ed.

Banfield, E. J.

- 1908, 1910, 1913 eds. *The Confessions of a Beachcomber . . . in Tropical Queensland*, pp. 239-246. London.

Bernaldez, Andres.

1856. *Historia de los Reyes Catolicos*, pp. 54-55. Granada. Madrid, 1870. MS. ante 1500.

Bordoni, Benedetto.

1527. *Isolario*.

Brassey, Lady Anne.

1885. *In the Trades, the Tropics, and the Roaring Forties*, pp. 168-169. New York.

Breton, Raymond.

1665. *Dictionnaire Caraibe-François*, p. 70. Auxerre. Réimprimé par Jules Platzmann (edition fac-simile); Leipzig, 1892.

Brussel, Th. van.

1729. *Natuurkundige Beschryving*, pp. 84-85, fig. Amsterdam.

Bullen, Frank T.

1904. *Denizens of the Deep*, p. 123. Chicago.

Casas, Fray Bartolome de las.

1875. *Historia de las Indias*, tomo II, p. 56. Madrid. (MS. about 1561.)

Cobo, Barnabe.

1891. *Historia del Nuevo Mundo*, Vol. II, pp. 180-181. (Edited by Marcos Jiminez de la Espada). Sevilla.

Coghlan, T. A.

1911. Article on Queensland. *Encyclopædia Britannica*, II ed., Vol. XXII, p. 735.

(Columbus, Christopher).

1870. Extract from *Journal of Second Voyage*. In Chap. 126 of Andres Bernaldez's *Historia de las Reyes Catolicos*, MS. ante 1500, published at Granada 1856, and Madrid 1870.

Columbus, Ferdinand.

- The History of the Life and Actions of Admiral Christopher Columbus and his Discovery of the West Indies Called the New World*. In *Churchill's Voyages*, Vol. II, 1732, p. 560. Also in *Kerr's Voyages and Travels*, Vol. II, 1811, pp. 7 and 117.

Dampier, William.

1729. *Dampier's Voyages*, Vol. II, part 3, *A Discourse on the Winds*, etc. . . . , p. 110. 6 ed., 1729. (Edited by John Masefield and reprinted by Richards, London, 1906.)

Eastman, C. R.

1915. *Early Figures of the Remora*. *Nature*, Vol. 95, pp. 344-345, 2 figs.

- 1915a. *Columbus on the Remora*. *Copeia*, no. 19, pp. 11-12.

1916. *The Reversus. A Fishing Tale of Christopher Columbus.* Scientific Monthly, pp. 31-40, 5 figs.; Americana, Vol. II, pp. 438-446; Bulletin Pan American Union, Vol. 43, pp. 368-371.
- Eden, Richard.
1555. *The Decades of the Newe Worlde or West India, etc.* Wrytten in the Latine Tounge by Peter Martyr of Angleria, and Translated into Englyshe by Rychard Eden. Londini. The First Booke of the Decades of the Ocean, 1511, p. 76 1555 A. D. (folios 14-15 in *The First Three English Books on America* (1511?) Being Chiefly Translations, Compilations, etc., by Richard Eden. Edited by Edward Arber, London, 1895).
- Galvano, Antonio.
1601. *The Discoveries of the World from their first Original unto the Yeere of our Lord 1555.* Briefly Written in the Portugall Tongue by Antonio Galvano, Governor of Ternate, the Chiefe Island of the Malucos; corrected, quoted, and now published in English by Richard Hakluyt, Londini, 1601. (Original ed. in Portuguese published 1563. Accessible in Hakluyt Society, Vol. 30, 1862; in Portuguese [text of 1653] and in Hakluyt's Eng. ed. of 1601, edited by C. R. D. Bethune.)
- Gesner, Konrad von.
1558. *Historia Animalium*, Book IIII, pp. 483-484, *De Gviacano vel Reverso Pisce Indico*, fig. Zurich.
1875. *Das Fishbuch*, p. L, fig. Zurich.
- Gill, William Wyatt.
1876. *Life in the Southern Isles, or Scenes and Incidents in the South Pacific and New Guinea*, p. 292. London.
- Gomara, Francisco Lopez de.
1553. *Historia General de las Indias*, folio XIII. Medina del Campo.
- Gosse, P. H.
1851. *Natural History, Fishes*, p. 270. London.
- Haddon, A. C.
1889. *The Employment of the Suckerfish (Echeneis) in Turtle-fishing.* Nature, Vol. 39, pp. 385-386.
1890. *The Ethnography of the Western Tribes of Torres Straits.* Journal Anthropological Institute of Great Britain and Ireland, Vol. 19, pp. 349-350.
- 1890a. [Use of the Sucker-fish, *Echeneis naucrates*, for Fishing in Torres Straits.] Folk Lore, Vol. I, p. 80.
1901. *Head Hunters, Black, White, and Brown*, pp. 155-156. London.
- 1904, 1908, 1912. *Reports Cambridge Anthropological Expedition to Torres Straits*: Vol. V, 1904, pp. 44-46, 67, 92; Vol. VI, 1908, pp. 4, fig.; 41-42; Vol. IV, 1912, pp. 163-165, figs.; 221, fig.
- Hernandez, Franciscus.
1665. *Quatre Libros. De la Naturaleza y Virtudes de la Plantas y Animales que Estan Recividos en el Uso de Medicina en la Neuva Espana*, pp. 183-184. Mexico City.

Herrera, Antonio de.

1601. *Historia General de las Indias Occidentales*. Translated by Capt. John Stevens, Vol. I, p. 130, London, 1725. Also in Churchill's *Voyages*, Vol. V, p. 631, 1732; and in Kerr's *Voyages*, Vol. II, p. 322.

Holder, Charles Frederick.

1899. *Stories of Animal Life*, pp. 42-43, fig. New York.
1903. *The Big Game Fishes of the United States*, pp. 60, 80, 115, 125. New York.
1905. *The Remoras*. *Scientific American*, Vol. 93, pp. 162-163, fig.
1906. *Half Hours with Fishes, Reptiles and Birds*, p. 80, fig. New York.
1908. *Big Game at Sea*, pp. 109, 129-130, 158. New York.
1910. *Recreations of a Sportsman on the Pacific Coast*, pp. 166-169. New York.

Holmwood, Francis.

1883. [Fishing with the Chazo in Zanzibar.] In *Fisheries of Zanzibar*, in *Official Catalogue, International Fisheries Exhibition*, London, 1883, pp. 381-382.
1884. *On the Employment of the Remora by Native Fishermen on the East Coast of Africa*. *Proceedings Zoological Society of London* for 1884, pp. 411-413, 2 figs.

Hudson, Charles Bradford.

1893. *Curious Breadwinners of the Deep*. *Cosmopolitan Magazine*, Vol. 15, p. 756, fig.

Humboldt, Alexandre de.

1826. *Essai Politique sur l'Isle de Cuba*, pp. 361-364.
1833. *Recueil d'Observations de Zoologie et Anatomie Comparée*, Vol. II, pp. 192-193 in *Voyage de Humboldt et Bonpland*, Deuxième Partie. Paris.
1860. *Personal Narrative of Travels to the Equinoctial Regions of America during the Years 1779-1804*. Translated and edited by Thomasina Ross. Vol. III, pp. 182-186.

Jardine, John.

1866. *Description of the Neighborhood of Somerset, Cape York, Australia*. *Journal Royal Geographical Society*, London, Vol. 36, pp. 79-80.

Kent, W. Saville.

1893. *The Great Barrier Reef of Australia; its Products and Potentialities*, p. 321. London.

Lacépède, B. G. E.

1829. *Histoire Naturelle des Poissons*, tome III, p. 490. Paris.

MacGillivray, John.

1852. *Narrative of the Voyage of H. M. S. "Rattlesnake," Vol. II*, pp. 21-22. London.

(Peter Martyr).

1504. *Libretto de Tutta la Navigazione de Re de Spagna et de le Isole et Terrene Novamente Trovati*, chapter XV. Venezia, edited by Angelo Trivigiano.

1507. Paesi Nouamente Retrouati et Nous Mondo da Alberico Vesputio Florentino Intitulato, chapters LXXXIIII-CXIIII.
- Peter Martyr.
1511. De Orbe Novo, Decade I, Liber 3; Decade VIII, Liber 8. Seville. (Translated by F. A. MacNutt, and published by Putnam, 2 Vols., New York, 1912.)
- Meek, A. S.
1913. A Naturalist in Cannibal Land, p. 205. London.
- Middleton, Charles Theodore.
1777. A New and Complete System of Geography; Country of Natal, Vol. I, p. 388. London.
- Nieremberg, Johannes Eusebius.
1635. Historia Naturæ, Libris XVI. Book XI, Chap. IV, pp. 250-255, fig. Antwerpiae.
- Ober, Frederick.
1901. Crusoe's Island: A Bird Hunter's Story, pp. 227-230, fig. New York.
- Ogilby, John.
1671. America: Being the Latest and Most Accurate Description of the New World, etc., pp. 49-50, fig. London.
- Oliver, S. Pasfield.
1909. The Life of Philibert Commerson, D.M., Naturaliste du Roi. An Old-World Story of French Travel and Science in the Days of Linnaeus, pp. 170-171. London.
- Oviedo y Valdez, Gonzalo Fernandez de.
1547. Cronica de las Indias, pp. cvii and 107. Salamanca.
- Poe, Felipe.
- 1856-1858. Memorias Sobre la Historia Natural de la Isla de Cuba, tomo II, pp. 249-252. Habana.
- Pollen, François P. L.
1874. Les Pêches a Madagascar et ses Dépendances. In Faune de Madagascar, IV, by F. P. L. Pollen and D. C. van Dam, pp. 2-3. Leiden.
- Ramusio, Giovanni Batista.
1606. Della Historia dell' Indie, Liber XIII, Cap. X, pp. 133-134. Venetia.
- Rivers, W. H. R.
1904. Reports Cambridge Anthropological Expedition to Torres Straits: Vol. V, p. 149.
- Robinson, Phil.
1883. Fishes of Fancy—Their Place in Myth, Fable, Fairy Tale, and Folk-Lore. Handbook Great International Fisheries Exhibition, pp. 22-23. London.
- Roth, H. Ling.
1889. Use of Sucker-fishes in Fishing. Nature, Vol. 39.
- Roth, W. E.
1901. Food; its Search, Capture and Preparation. North Queensland Ethnography, Bulletin 3.

Salt, Henry.

1814. *A Voyage to Abyssinia and Travels into the Interior of that Country Executed under the Orders of the British Government in the Years 1809 and 1810*, p. 49. London.

Selater, P. L.

1889. Use of the Remora in Fishing. *Nature*, Vol. 39, p. 295.

Semon, Richard.

1899. In the Australian Bush and on the Coast of the Coral Sea, p. 290. London.

1903. Im Australischen Busch und den Küsten des Korallenmeeres. 2. Auflage, Leipzig.

Sibree, James.

1915. *A Naturalist in Madagascar*, p. 311. London.

Sparman, Andre.

1787. *Voyage au Cap de Bonne Espérance*, pp. 431-432. Paris.

Thacher, John Boyd.

1903. Christopher Columbus: His Life, His Works, His Remains, Vol. II, pp. 215-218, 318, 360-363, 439-498. New York.

Thomas, N. W.

1906. *Natives of Australia*, p. 90. London.

Townsend, C. H.

1915. The Power of the Shark-Sucker's Disk. *Bulletin New York Zoological Society*, Vol. XVIII, pp. 1281-1283, 3 figs.

Wills, James, translator.

1897. *A Fishing Fish (From an Old Malagassy Manuscript)*. Antananarivo Annual, Vol. VI, p. 123.

Winsor, Justin.

1892. Christopher Columbus and How He Received and Imparted the Spirit of Discovery, 5th ed., pp. 9-10, 18, 34-56, 293. Boston.